

What Is Claimed Is:

1. Apparatus for performing beating heart surgery, said apparatus comprising:
  - a cannula having a proximal end and a distal end;
  - an aortic filter in connection with said cannula, said aortic filter having a proximal side and a distal side;
  - a check valve in connection with said cannula, said check valve disposed on said distal side of said aortic filter; and
  - a coronary artery filter in connection with said cannula, said coronary artery filter having a proximal end and a distal end, and said distal end of said coronary artery filter extending distally away from said distal end of said cannula.

2. Apparatus according to claim 1 wherein said cannula permits delivery of an instrument to a surgical site.

3. Apparatus according to claim 1 wherein the porosity of said coronary artery filter is different from the porosity of said aortic filter.

4. Apparatus according to claim 1 wherein said coronary artery filter has a larger mesh size than said aortic filter.

5. Apparatus according to claim 1 wherein said apparatus is configurable to form a substantial seal with a vascular structure.

6. Apparatus according to claim 5 wherein said vascular structure is an inner surface of an aorta.

7. Apparatus according to claim 1 further comprising at least one impermeable membrane extending longitudinally along a surface of said coronary artery filter.

8. Apparatus according to claim 7 wherein said at least one impermeable membrane has a proximal end and a distal end in an orientation corresponding to said proximal end of said cannula and said distal end of said cannula, respectively, and said proximal end of said at least one impermeable membrane is connected to said coronary artery filter so as to channel blood flow to a coronary artery during diastole.

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9. Apparatus according to claim 1 wherein said coronary artery filter forms a perfusion conduit on a surface thereof so as to allow blood flow to a coronary artery during diastole.

10. Apparatus according to claim 9 further comprising an impermeable membrane extending longitudinally along a surface of said coronary artery filter, wherein said impermeable membrane having a proximal end and a distal end in an orientation corresponding to said proximal end of said cannula and said distal end of said cannula, respectively, and

said proximal end of said impermeable membrane is connected to said coronary artery filter so as to channel blood flow to said coronary arteries during diastole.

11. Apparatus according to claim 10 wherein said apparatus is configurable to form a substantial seal with an aorta, with said outer surface of said coronary artery filter leaving said perfusion conduit unobstructed.

12. Apparatus for performing beating heart surgery according to claim 1 further comprising at least one conduit having a proximal end and a distal end in an orientation corresponding to said proximal end of said cannula and said distal end of said cannula, respectively, said proximal end of said at least one conduit being positionable to said proximal side of said aortic filter, and said distal end of said at least one conduit being positionable to coronary arteries.

13. Apparatus for performing beating heart surgery, said apparatus comprising:

a cannula having a proximal end and a distal end;

an aortic filter in connection with said cannula, said aortic filter having a proximal side and a distal side;

a check valve in connection with said cannula, said check valve disposed on said distal side of said aortic filter; and

an impermeable membrane in connection with said cannula, said impermeable membrane having a proximal end and a distal end, and said distal end of said impermeable membrane extending beyond said distal end of said cannula in a direction from said proximal end of said cannula to said distal end of said cannula.

14. Apparatus according to claim 13 wherein said cannula permits delivery of an instrument to a surgical site.

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15. Apparatus according to claim 13 wherein said aortic filter and said impermeable membrane define a passageway on an outer surface thereof so as to allow blood flow to coronary arteries during diastole.

16. Apparatus according to claim 15 wherein said distal end of said impermeable membrane is adapted to make a sealing engagement with a periphery of an aortic valve.

17. Apparatus for performing beating heart surgery, said apparatus comprising:

a cannula having a proximal end and a distal end;  
and

a filter in connection with said cannula, said filter having a proximal end and a distal end, said distal end of said filter extending beyond said distal end of said cannula in a direction from said proximal end to said distal end of said cannula;

wherein said distal end of said filter is adapted to make a sealing engagement with a periphery of an aortic valve.

18. Apparatus according to claim 17 wherein said cannula permits delivery of an instrument to a surgical site.

19. A method for performing beating heart surgery, said method comprising:

providing apparatus for performing beating heart surgery, said apparatus comprising:

a cannula having a proximal end and a distal end;

an aortic filter in connection with said cannula, said aortic filter having a proximal side and a distal side;

a check valve in connection with said cannula, said check valve disposed on said distal side of said aortic filter; and

a coronary artery filter in connection with said cannula, said coronary artery filter having a proximal end and a distal end, and said distal end of said coronary artery filter extending distally away from said distal end of said cannula; deploying said apparatus in an aorta; performing a procedure on the aortic valve; and removing said apparatus from the aorta.

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20. A method for performing beating heart surgery, said method comprising:

providing apparatus for performing beating heart surgery comprising:

a cannula having a proximal end and a distal end;

an aortic filter in connection with said cannula, said aortic filter having a proximal side and a distal side;

a check valve in connection with said cannula, said check valve disposed on said distal side of said aortic filter;

a coronary artery filter in connection with said cannula, said coronary artery filter having a proximal end and a distal end, and said distal end of said coronary artery filter extending distally away from said distal end of said cannula;

    said coronary artery filter comprising a perfusion conduit on an outer surface thereof so as to allow blood flow to said coronary arteries during diastole; and

    deploying said apparatus in an aorta;

    performing a procedure on the aortic valve; and  
    removing said apparatus from the aorta.

21. A method for performing beating heart surgery, said method comprising:

    providing apparatus for performing beating heart surgery comprising:

    a cannula having a proximal end and a distal end;

an aortic filter in connection with said cannula, said aortic filter having a proximal side and a distal side;

a check valve in connection with said cannula, said check valve disposed on said distal side of said aortic filter; and

an impermeable membrane in connection with said cannula, said impermeable membrane having a proximal end and a distal end, and said distal end of said impermeable membrane extending beyond said distal end of said cannula in a direction from said proximal end of said cannula to said distal end of said cannula;

deploying said apparatus in an aorta;

performing a procedure on the aortic valve; and removing said apparatus from the aorta.

22. A method for performing beating heart surgery, said method comprising:

providing apparatus for performing beating heart surgery comprising:

a cannula having a proximal end and a distal end;

an aortic filter in connection with said cannula, said aortic filter having a proximal side and a distal side;

a check valve in connection with said cannula, said check valve disposed on said distal side of said aortic filter;

a coronary artery filter in connection with said cannula, said coronary artery filter having a proximal end and a distal end, and said distal end of said coronary artery filter extending distally away from said distal end of said cannula; and

at least one conduit having a proximal end and a distal end in an orientation corresponding to said proximal end of said cannula and said distal end of said cannula, respectively, said proximal end of said at least one conduit being positionable to said proximal side of said aortic filter, and said distal end of said at least one conduit being positionable into a coronary artery;

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deploying said apparatus in an aorta;  
performing a procedure on the aortic valve; and  
removing said apparatus from the aorta.

23. A method for performing beating heart surgery, said method comprising:

providing apparatus for performing beating heart surgery, said apparatus comprising:

a cannula having a proximal end and a distal end; and

a filter in connection with said cannula, said filter having a proximal end and a distal end, said distal end of said filter extending beyond said distal end of said cannula in a direction from said proximal end to said distal end of said cannula;

wherein said distal end of said filter is adapted to make a sealing engagement with a periphery of an aortic valve;

deploying said apparatus in an aorta;  
performing a procedure on the aortic valve; and  
removing said apparatus from the aorta.